Sierra Climate Adaptation & Mitigation Partnership Policy Recommendations for 2017 Update of *Safeguarding California: Reducing Climate Risk*

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Recommendations prepared by the Sierra CAMP, a program of the Sierra Business Council.

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About Sierra CAMP

Sierra CAMP (Sierra Climate Adaptation & Mitigation Partnership) is a public-private, cross-sector partnership dedicated to promoting climate action and resilience in the Sierra Nevada region, from the Oregon border in the north to the Tehachapis in the south. Sierra CAMP is a member of the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA), which is supported by the Governor's Office of Planning and Research, and is hosted as a project of the Sierra Business Council. Please see Appendix 2 for boundary map.

About Sierra Business Council

Sierra Business Council (SBC) is working to secure the environmental, social, and economic health of the Sierra Nevada for this and future generations by implementing projects that model proactive change. SBC advocates on behalf of the Sierra, helps small businesses start, grow, and thrive, and fosters climate resiliency throughout the region. Our goal is a diverse inventive, and sustainable region where the economy is vibrant, the land is thriving, and the communities offer opportunities for all. More information on SBC's impact can be found at www.sierrabusiness.org.

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Introduction

The impacts of climate change are being felt all across California, including the Sierra Nevada and southern Cascade. Since 2009, several of the most extreme natural events in the state's recent history have occurred in the Sierra Nevada region, including severe wildfires, diminishing snowpack, and the highest winter average temperatures in over a century (California Natural Resources Agency, 2016). California is working to build resilience in its communities and ecosystems through comprehensive planning for climate change adaptation, most recently resulting in the 2014 report *Safeguarding California: Reducing Climate Risk*. This Sierra CAMP policy white paper synthesizes biophysical research and policy expertise on the Sierra Nevada region to make recommendations for *Safeguarding California*'s 2017 update.

For the purposes of this report, "Sierra Nevada" refers to the Sierra Nevada Conservancy's 22-county region in California stretching from Modoc County in the north to Kern County in the south, including the California portion of the Lake Tahoe Basin.

Due to the array of ecosystem services the Sierra Nevada region provides to the state, including water supply and carbon storage, a healthy Sierra Nevada facilitates resilience for communities across the state. This report highlights the important biophysical and economic relationships between the Sierra Nevada and downstream communities, calling attention to regulatory measures and opportunities for cooperation that leverages the state's existing efforts to adapt to climate change. The recommendations made in this report are aimed at helping to guide the California Natural Resources Agency (CNRA) and other relevant state agencies in the development and implementation of climate adaptation planning across the state with an emphasis on the 2017 update of *Safeguarding California: Reducing Climate Risk*. Note: some recommendations in this report may fall outside of the responsibilities of CNRA and other state agencies – perhaps even requiring legislative action; we nevertheless identify them as part of the larger portfolio of policies needed to build meaningful and lasting climate resilience in the Sierra Nevada region and downstream communities.

Priorities

Five key priority areas guide the policy recommendations found in this document. The priority areas are:

1. **Integrated Watershed Investment:** Adopt a whole-system approach that identifies and supports integrated solutions throughout the entire system from the Sierra Nevada to the sea. Facilitate stronger connections between California's urban and rural regions to support joint planning and greater investment in mutually beneficial ecosystem restoration projects as well as agricultural and working lands conservation. Leverage partnerships across sectors, regions, agencies, and different levels of government.

2. **Forest Restoration:** Manage Sierra Nevada forests to secure ecosystem services including carbon storage, water security, current and future wildlife habitat, recreational opportunities and community vitality for upstream and downstream Californians who rely on those resources. Demonstrate best practices in improving forest health, reducing wildfire risk and increasing biomass utilization through public and private funding for landscape-scale projects.

3. **Regional Economic Development:** Strengthen local economies by growing investment and incubating natural resource-related industries such as sustainable forestry and tourism. Secure emission reductions and economic resilience by promoting energy efficiency, affordable housing, and sustainable

business practices in communities. Incorporate local contracting and workforce training programs into climate adaptation strategies including restoration projects.

4. **Preparedness and Public Health:** Improve individual, community, and business preparedness for climate-related disasters including wildfire, extreme heat, poor air quality, flooding, and threats to water supplies. Invest in adaptation measures, such as community emergency management plans, wildfire protection, and community forestry to reduce health and safety risks to communities.

5. **Structural Recommendations:** Reform climate change investment methodologies to remove barriers to investment in the Sierra Nevada.

Policy Recommendation Highlights

The recommendations in this report aim to benefit the Sierra Nevada and the state as a whole by cooperatively working toward many of California's climate change objectives. Some of the most necessary changes in the Sierra Nevada include:

Priority	Suggestions
Integrated Watershed Investment	1. Invest in natural infrastructure across the state's distributed water network starting with forest and meadow restoration at the top of the watershed and spanning multiple Integrated Regional Water Management regions 2. Create and maintain existing inter-regional and multi-party funding mechanisms to magnify impact and secure watershed services, and fund large landscape-scale demonstration projects
Forest Restoration	1. Direct Greenhouse Gas Reduction Fund (GGRF) investments to forest restoration projects and incentives to maintain working forests 2. Foster growth of biomass power and product sectors in the Sierra Nevada 3. Support quantification of climate benefits and co-benefits of forest restoration
Regional Economic Development	1. Expand Affordable Housing Sustainable Communities' (AHSC) Rural Innovation Project Area (RIPA) program and extend funding to tribal areas 2. Explore the use of alternative financing instruments to leverage downstream capital to fund resilience projects and create rural jobs
Preparedness and Public Health	1. Prioritize policies and projects that create public health-related co-benefits 2. Develop best practices in public health accounting 3. Encourage cross-sector coordination and collaboration
Structural Recommendations	1. Improve GGRF disadvantaged communities screening criteria to recognize disadvantaged people in the Sierra Nevada and other rural areas across the state 2. Identify supplementary delivery mechanisms for GGRF funding in addition to Metropolitan Planning Organizations (MPOs)

Priority 1: Integrated Watershed Management

More than 60% of the state's developed water supply originates from the Sierra Nevada (Sierra Nevada Conservancy, 2011). The region's snowpack provides water storage while its forests and meadows regulate water quality and timing. This water supply is crucial for both users in the Sierra Nevada as well as further downstream. Snowpack is disappearing 5 to 30 days earlier than in the past half century, and spring snowpack in the Sierra Nevada is projected to decline by 25-40% by 2050. Toward the end of the century, losses could reach up to 90% (Cayan et al., 2006; California Climate Change Center, 2006).

Changes in snowpack will negatively affect the state's water supply for cities and agriculture, hydropower generation, outdoor recreation, and groundwater supplies all throughout the year (Risky Business, 2014). Climate change also presents risks to water quality such as mercury impairment and sedimentation occurring after catastrophic wildfire, including the Bay-Delta estuary (Sierra Nevada Conservancy, 2012). These risks have implications for wildlife species, vital infrastructure like dams and water treatment plants, and human health in the Sierra Nevada and throughout California.

To cope with these mounting risks, an integrated approach connecting water users and sources throughout the state —from the Sierra Nevada to the sea—is needed to secure benefits for people and maintain natural lands and infrastructure. New efforts are needed to build on California's Integrated Regional Water Management (IRWM) program to encourage planning and coordination between regions in order to improve efficiency and pursue mutually beneficial outcomes.

Starting with the top of the watershed, the forests of the Sierra Nevada provide valuable watershed services to the entire state. Investments to restore and optimize watershed functions should be promoted to ensure ample clean water will be delivered to agricultural users as well as cities and towns throughout California. These investments are not only cost-effective, but also have profound benefits for wildlife, recreation, and renewable energy (Podolak et al., 2015).

Drought, wildfire, and development combine to threaten the matrix of federal, state, and private lands that make up the forests of the Sierra Nevada. Partnerships and funding mechanisms that span upstream, downstream, and across land holdings within the Sierra Nevada are needed to facilitate investment in the watershed as a whole.

With the risk of reduced precipitation and a growing population, securing water quality and quantity for the state is paramount to responding to the mounting challenges affecting urban, suburban, and rural Californians. No single region or type of project can address these risks independently; only through an integrated, whole-system watershed investment framework can California adapt to the myriad changes already underway.

Policy Recommendations

Invest in natural infrastructure across the state's distributed water network starting with the top of the watershed

- **Sierra Nevada Mountains:** Keep precipitation levels in the system for as long as possible to increase water yield and quality and moderate flow and timing. Adopting ecological forest management principles such as sustainable forest thinning ensures that snow reaches the ground, instead of evaporating off of the tops of trees and being absorbed by overabundant small diameter growth, while maintaining snowpack through the shade. Due to decades of fire suppression and in-growth, the landscape is in need of restoration. In addition to forest restoration, the state should approve funding to restore meadows, which store snowmelt in high-elevation areas for release later in the season; this would substantially improve water yield and timing across the Sierra Nevada-Southern Cascade mountains region.

- **Foothills:** Fund cost-share programs to restore meadows, wetland, and riparian areas in ranches and agricultural lands. Protect natural water-regulating infrastructure that working forests and agricultural lands provide, through large landscape planning, conservation easements, acquisitions and incentives that concentrate development. Encourage the use of pervious pavements and develop cisterns and infiltration basins to capture water and improve water quality.

- **Central Valley:** Integrate downstream water efficiency measures to complement watershed protection and restoration, including irrigation efficiency upgrades and agricultural best management practices to make the best use of limited water resources. Sustainable groundwater management is also vital to ensuring the future of agriculture in California. If watershed improvement projects are capable of producing significant improvement in water flows, consider using excess water for groundwater recharge in surplus years. Examples include efforts in the Kings River Conservation District with the California Almond Board.

- **Urban and coastal areas:** Efforts to ensure water quality and quantity upstream should be matched with efficiency measures downstream. Natural infrastructure can help capture stormwater for use in urban areas as well as help adapt to anticipated increased flooding risk. These efforts should be combined with sustainable groundwater basin management, groundwater cleanup in urban areas, and water recycling programs and groundwater cleanup in urban areas.

- Fund large landscape-scale demonstration projects in a watershed of statewide significance, pairing water yield data with data on the impacts of climate change.

- Develop better understanding and quantification of benefits of natural infrastructure improvements, including benefits to water supply, wildlife, and recreation. Develop and fund projects that improve the quantification methodology for benefits from the upper watershed to the end users.

- Incorporate climate change projections into flood infrastructure planning. Natural flood infrastructure projects, such as meadow restoration in the Sierra along with bioswale construction in urban and suburban areas are cost-effective means to reduce flood risk and are consistent with the Governor's call for further investment in natural infrastructure contained in Executive Order B-30-15.

Create and maintain existing inter-regional and multi-party funding mechanisms

- The Sierra Nevada watershed is a matrix of private, federal, and utility lands. Funding from the Greenhouse Gas Reduction Fund (GGRF) should be used as an anchor for matching funds from federal, local, utility, and private investment to promote an all-lands approach to securing watershed benefits. The state should facilitate these partnerships to have the greatest impact on watershed protection. Study and support the expansion of private and user-fee based investments in whole system management.

- Direct watershed funding through the Sierra Nevada Conservancy's (SNC) Watershed Improvement Program (WIP). WIP is an ideal mechanism to facilitate investment in watershed services throughout the state. SNC has existing connections to stakeholders in headwaters counties, local government representation on its governing board, and partnerships already in place through designation as a federal California Headwaters Partnership (Sierra Nevada Conservancy (b)). WIP was created by SNC, through funding provided by Proposition 1, for the specific purpose of bringing multiple partners together to coordinate efforts and ensure effectiveness (Sierra Nevada Conservancy (a)). SNC also has a proven track record of successful grant making through the distribution of funds made available by Propositions 84 and 1 and developed key metrics of success though its System Indicator Project (Sierra Nevada Conservancy (c)).

- Encourage the University of California system to locate a Bio-Economy* Innovation Laboratory in the Sierra Nevada to develop new products and services that can create a market for woody renewables and agriculture-based feedstocks utilizing biotechnology to replicate and replace the vast array of petrochemicals now used to make plastics, textiles, building materials, and countless other products that permeate modern life.

- Continue to use regional and inter-regional partnerships such as the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA) as a way to identify and prioritize statewide water supply and adaptation measures using a coordinated planning process where upstream and downstream users can pursue mutually beneficial initiatives. Collaborative groups such as ARRCA can be used to synchronize efforts between IRWM regions. The current program does not encourage coordination between regions to invest in projects that have water benefits spanning multiple regions.

* Bio-Economy refers to economic activity that is fueled by research and innovation in the biological sciences. In this case, the Bio-Economy is the application of biotechnology to renewable biological resources for the production of food, fiber, bio-based products and energy to replace greenhouse gas emitting processes.

Priority 2: Forest Restoration

Sierra Nevada forests face multiple challenges including larger and more severe wildfires, escalating tree mortality, low snowpack levels, higher rain-snow transition zones, and increased development in forested areas. The health and integrity of these forestlands are foundational to the region's ability to provide services to the state (Sierra Nevada Conservancy, 2012). These services include storage, filtration and regulation of the majority of the state's water supply, over 50 million recreational visitor-days per year, carbon sequestration, and wildlife habitat.

Approximately 70% of the productive forestland in the region is publicly owned, with the majority of that managed by the U.S. Forest Service (USFS). A combination of fire suppression and a reduction in active forest management on USFS land in the Sierra Nevada has exacerbated the effects of climate change – yielding a forest that is increasingly susceptible to severe wildfire and widespread forest mortality due to drought, insects, and disease. In some areas of the southern Sierra Nevada, tree mortality has already surpassed 40 trees per acre (CAL FIRE, 2016a). If mortality rates continue on this trend northward, the region's forests may shift from the state's largest carbon sinks to net emitters of greenhouse gases (GHG). These trends also pose significant threats to public health and safety; biodiversity and wildlife habitat; and recreation, tourism, and natural resource-based economies.

Forests in the Sierra Nevada provide an array of opportunities for climate change adaptation and mitigation. Fuel reduction treatments that include selective thinning of small diameter trees along with prescribed and managed wildfire can significantly reduce the risk of severe wildfire. These actions also help protect vital ecosystem services and public health, as well as reducing the emission of GHGs such as carbon dioxide and attenuating the largest source of black carbon in the state (California Air Resources Board, 2015).

Current air quality standards severely limit the use of prescribed fire as a tool to reduce fuel loads across the landscape. While these policies protect public health in the short term, they increase the likelihood of large, damaging wildfires that release even more particulate matter. To enable landscape-scale forest restoration in the Sierra Nevada, stable funding, infrastructure improvements, policy adjustments, and increased workforce capacity are necessary.

Though it supports many jobs in Sierra Nevada counties and accounts for half of the state's timber yield, the regional forest products industry has lost roughly $1.2 billion across its 22 counties since 1989 (Brink, 2015 and CAL FIRE, 2010). A widespread reduction in infrastructure and capacity in the forestry sector has taken a toll on the regional economy and limits the feasibility of many forest restoration initiatives. Workforce training and small business incubation can ameliorate recent declines in the regional forestry sector and should be sited in disadvantaged communities in the Sierra Nevada[†] (see Section 3, below).

Along with a decline in workforce, many sawmills in the Sierra Nevada have also closed. Investment in new infrastructure to process small diameter logs will increase the financial viability of forest restoration work. Biomass utilization for value-added products can provide local markets for wood products and produce renewable energy that can be sold to the electrical grid. AB 590 and the California Public Utilities Commission

[†] This report uses the California Department of Water Resources definition of disadvantaged communities, defined as an area with a median income less than 80% of the State median income. There are 180 of such communities in the Sierra Nevada, 120 of which have a median income less than 60% of the state median. See Section 5, below for more information on disadvantaged communities.

(CPUC) Resolution E-4770 provide incentives to develop biomass plants and serve as the foundation of developing a robust biomass sector that supports forest restoration projects. Furthermore, SB 1122 provides an additional incentive by requiring the procurement of at least 50 megawatts of power per year produced from forest biomass.

Today, federal funding for stewardship contracting is insufficient to meet the USFS Region 5 goal of restoring 500,000 acres per year across the Sierra. Forest management objectives cannot be achieved without increasing biomass utilization as a market incentive to make forest thinning more cost-effective. Furthermore, planning and implementation of these projects will require additional funding. Reducing the risk of severe wildfire significantly benefits downstream water users by protecting watersheds from erosion and sedimentation as well as the public health of citizens throughout the state. State funding for forest restoration projects can serve as an anchor to attract matching funds from water utilities, local air quality districts and other public and private sources.

New jobs and economic development opportunities could be advanced in the Sierra Nevada and other regions of the state by investing in the development of a "Bio-economy" to create markets for woody renewables and agriculture based products and speeding the commercialization of new technologies producing renewable fuels, electricity generation, bio-char, chemicals, polymers, cellulosic nano-fiber, and low carbon emitting building materials. This would have the co-benefit of creating market incentives for forest thinning and management by making it more cost effective. (Milken Institute, 2013).

The forests of the Sierra Nevada provide essential watershed, recreation, habitat, employment, wood products, and carbon sequestration benefits to residents throughout California. Widespread restoration provides an opportunity to protect and augment these services that are increasingly threatened by the effects of climate change while yielding many co-benefits for wildlife already struggling to adapt to climate change. The following policy recommendations will help address the primary barriers to increasing the pace and scale of forest restoration in the Sierra Nevada.

Policy Recommendations

Direct Greenhouse Gas Reduction Fund investments to forest restoration projects and incentives to maintain working forests

- Fund selective thinning and controlled burn projects in collaboration with USFS, while amplifying associated benefits for water regulation, wildfire risk mitigation, air quality, carbon storage, and improved wildlife habitat. Continue to build on the partnership between the state and USFS through SNC's WIP and the Good Neighbor Authority.

- In addition to fuel treatment projects, fund initiatives to restore meadows, wetlands, and soils to capture flood flows, increase water storage, affect the timing of water release, improve wildlife habitat, and maximize carbon sequestration benefits.

- Adjust air quality policy to allow for and encourage the use of prescribed burns where appropriate to provide net emissions benefits through improved forest health and reduced risk of large, damaging wildfires.

- Increase GGRF investment in the Natural and Working Lands sector to 20%, including a concomitant increase in the non-urban forestry portion of that sector, in recognition of the priority the Governor has placed on forest carbon capture and sequestration, reduction of forest-related short-lived climate

pollutants, and organic waste diversion to create bioenergy and other products. Easements and acquisitions should be prioritized across the landscape through coordination with similar restoration efforts led by USFS, especially in adjacent lands.

- Expand criteria for the Sustainable Agricultural Land Conservation Program administered by the Strategic Growth Council to include forestland. Forests are at risk of conversion through development, so avoided conversion and avoided emissions from easements on forestland should be accepted for funding under the SALC program. In addition to reducing GHG emissions, keeping forests as forests will have valuable co-benefits for current and future wildlife habitat, recreational use and local economic sustainability.

- Amend air quality standards and policies to encourage the use of prescribed fire as part of forest restoration projects. Current standards protect human health in the short term but contribute to greater risk of larger, more dangerous wildfires that cannot be controlled. Prescribed fire days can be planned with air quality districts to protect vulnerable populations on burn days.

Foster continued growth of the biomass power sector in the Sierra Nevada

- Assist biomass producers in securing power purchase agreements (PPAs). Provide incentives and/or mandate utilities such as PG&E to continue Power Purchase Agreements with biomass facilities across the Sierra Nevada in order to support a supply chain for non-merchantable timber harvested during forest restoration projects. This will increase the economic feasibility of forest restoration.

- Expand on CPUC Resolution E-4770 to include forest biomass from outside of "high hazard zones" to support treatments designed to increase forest health and prevent wide-scale mortality throughout the region.

- Site a University of California Bio-Economy Innovation Laboratory in the Sierra Nevada.

- Pursuant to AB 590, make funding available to the State Energy Resources Conservation and Development Commission for the purposes of maintaining the current level of biomass power generation and revitalizing currently idle facilities in strategic locations and spur economic development in the Sierra Nevada. The North Fork Biomass Plant is a successful model of repurposing a former sawmill site to restoration-based infrastructure.

- Use full lifecycle accounting when comparing different fuel sources. For example, identify the benefits and co-benefits of using one source over another and quantify transportation and other external costs, rather than simply looking at cost per kWh of production. "Internalize the externalities" to reach a true comparison of societal costs and benefits of different fuel sources.

- Increase local, community-scale renewable energy production for greater climate resilience through combined heat and power system in Sierra Nevada counties.

- Alleviate the high costs associated with transporting feedstock from forest treatment areas to biomass facilities. Solutions include wider distribution of biomass facilities around the Sierra Nevada, increased technology in the field, and subsidies for transportation of feedstock, particularly during the present emergency situation due to tree mortality and high fire danger.

- Direct GGRF funding for Sustainable Transportation to California Energy Commission for biofuel production using woody biomass as feedstocks. Projects should be located in disadvantaged communities in the Sierra Nevada[‡] to maximize energy and economic efficiency by reducing biomass hauling distances and contribute to economic development in distressed areas (see Section 5 below).

Support quantification of climate benefits and co-benefits of forest restoration

- Design landscape-scale GGRF-funded projects to establish a region-wide GHG/carbon inventory, develop baseline assumptions, refine GHG/carbon quantification methodologies, and create a common approach to GHG/carbon accounting that considers project-specific co-benefits, lifecycle accounting, and integrated benefits across sectors (e.g. waste diversion, renewable energy, SCS, transportation, climate action plans).

- Use a carbon-focused view of success when evaluating GGRF funding opportunities instead of strictly considering GHG reductions. For example, increasing and securing carbon sequestration is just as important as reducing GHG emissions. GHG benefits from forest restoration projects should be accounted for over the full project period, a length of time that may be longer than current legislation considers (e.g. AB 32).

- Assist in developing metrics for accounting for wildfire emissions in: a) calculations regarding GHG benefits of forest treatment and biomass, and b) methane and black carbon reduction goals and calculations regarding benefits of forest treatment to reduce large damaging wildfires that are the primary source of black carbon, though not included in the Short-Term Climate Pollutants Plan.

- Use CAL FIRE's draft urban forestry grant guidelines as the basis for rural forest quantification of GHG benefits from GGRF funded forestry projects. This is an established methodology for quantifying carbon benefits from tree planting and should apply to rural projects in addition to urban ones. (CALFIRE, 2016b). Rural and wildland forestry projects have significant co-benefits for wildlife as well as urban residents that rely upon watershed services and recreation provided by forests in the Sierra Nevada.

- Develop a set of metrics to measure the benefits and co-benefits of Bio-Economy investments in the region and their applicability to other regions of the state.

[‡] As noted above, disadvantaged communities are those that have a median income below 80% of the state median income in this report.

Priority 3: Regional Economic Development

Due to heavy reliance on natural resources, rural Sierra Nevada communities disproportionately experience economic impacts due to climate change. The region's demographic characteristics, available occupations, lower earnings rates, higher poverty levels, and higher dependence on government transfer payments make its residents less able to adapt to dramatic community change (USDA Forest Service, 2014; Headwaters Economics). In the Sierra Nevada, many rural communities are dependent on tourism, recreation, water, timber, grazing and fisheries – all industries that are directly affected by the impacts of climate change on local natural resources.

The region faces economic challenges through the decline of timber, agriculture, and tourism-based industries. The central and northern Sierra Nevada region has unemployment rates exceeding 20%. One in five Sierra Nevada residents lives below the poverty line, a number that is consistently higher than the rest of California. Rural economies continue to suffer as families move in search of employment opportunities – in 2010, the region lost 145,000 jobs as a result of companies closing (Next10, 2015). The twelve counties entirely within the Sierra Nevada Conservancy region have been losing people each year since 2007 (Sierra Nevada Conservancy, 2010).

These recommendations are geared towards building economic resilience for people and communities in the Sierra Nevada and span multiple sectors including land use, community development, forestry, and energy. They emphasize opportunities for inter-regional approaches that leverage urban-rural cooperation. Urban investments to stimulate forest and watershed restoration activities that improve resilience for key downstream resources can have the co-benefit of bolstering economic resilience in the Sierra Nevada and maintaining the workforce capacity for continued restoration activities. Innovative approaches to financing and policy can help achieve these compatible goals.

Policy Recommendations

Invest in rural economic development that supports restoration-based economies

- Increase the Affordable Housing Sustainable Communities' (AHSC) Rural Innovation Project Area (RIPA) program from 10% to 20% of funds. This would bring it in line with California's Tax Credit Allocation Committee (TCAC) program upon which the definition of "rural" is modeled, and recognize the tremendous need for protection and management of the headwaters of the state's primary water system.

A "restoration economy" is an economy that deploys private sector strategies and business models to address the restoration of natural resources, adaptation to and mitigation of the impacts of climate change, and the promotion of a restorative built environment to improve the state of natural, social and financial capital in communities and ecosystems. Restoration economies can be deployed to:

- *Restore wetlands, forests and fisheries*
- *Promote local sustainable agricultural practices*
- *Redevelop or develop previously used brownfields, industrial sites, and under-utilized urban sites*
- *Promote infill or transit oriented development and affordable housing*
- *Create or restore sustainable and resilient infrastructure including transportation, power, solid waste, water and waste water systems*

- Add tribal lands to the list of entities eligible to apply for AHSC funds as a sole or joint applicant, allowing Native American tribal communities, many of which have populations smaller than 5,000 and reside in the Sierra Nevada, to apply for funding.
- Use GGRF funding to support the development of "restoration economies" in the Sierra Nevada.
  - Support launch of restoration economy "incubators" in appropriate local and regional offices (e.g. economic development authorities or small business centers).
  - Improve access to capital for restoration-oriented small businesses in need by using limited public capital to leverage private investment from a range of existing financing options, including social impact investors, direct public offerings, foundation grants, and seed funding.
  - Improve readiness of businesses to adapt to extreme weather events through data, supply chain, and emergency readiness training based on the Business Resilience in the Capitol Region project (Valley Vision, n.d.).
  - Create metrics to measure progress on restoration economy incubation.

Promote downstream urban investment in upstream natural resources

- Explore the use of alternative financing instruments to leverage downstream capital to fund resilience projects and create rural jobs. Potential instruments include resilience bonds or payments for ecosystem services (PES) for water or electricity. Examples of successful PES programs aimed at reducing wildfire risk and protecting water supply include Denver's Forests to Faucets Partnership and Santa Fe's Municipal Watershed Investment Plan.
- Maintain and expand partnerships between downstream beneficiaries of ecosystem services and Sierra communities seeking external funding for restoration projects, with an emphasis on the co-benefits created by these projects.

Priority 4: Preparedness and Public Health

By the end of the century, temperatures throughout the Sierra Nevada will likely increase by an average of more than 4 degrees Fahrenheit (California Energy Commission, 2015). In addition to increases in average high temperatures, average nighttime low temperatures are also likely to increase, impacting human health and drying vegetation further. One estimate centered in the Sierra Cascade Province near the Plumas, Lassen, and Modoc National Forests finds that average nighttime temperatures have already increased by 2.5 degrees Fahrenheit since 1895 (Merriam, Safford, and Sawyer, 2013). Consistently warmer temperatures and persistent drought conditions lead to longer and more severe wildfire seasons, further causing adverse air quality effects for communities in and near the Sierra Nevada. For example, the 2014 King Fire caused weeks of "very unhealthy" to "hazardous" air quality conditions for neighboring communities (Caiola, 2015).

Changes in temperature and precipitation will have further implications for public health and disaster preparedness. Poor air quality is linked to adverse public health outcomes by aggravating respiratory and heart conditions across the state, especially among young children and the elderly. One study found that a 10 $\mu g/m^3$ increase in $PM_{2.5}$ in the air, a common component of wildfire smoke, was linked to a 32% increased chance of death for people with diabetes, as well as a 28% higher chance for people with chronic obstructive pulmonary disease, asthma and pneumonia, 27% for people with congestive heart failure and 22% for people with inflammatory diseases (Laden, Schwartz, Speizer, & Dockery, 2006).

Rural areas throughout much of the Sierra Nevada are also uniquely vulnerable to many climate risks when compared to their urban counterparts. Conditions such as remoteness, lack of communication infrastructure, and dispersed population densities make it more challenging to respond to disasters, and resource limitations increase the difficulty of effective planning and preparation (Rural Health Information Hub, n.d.).

Pursuant to AB 32 §38562, the state must consider the co-benefits of GHG reduction measures, including improvements to the economy, environment, and public health. These policy recommendations support meeting the ambitious goals set out in AB 32 while maximizing the co-benefits achieved through GHG reduction activities.

Policy Recommendations

Prioritize policies that create co-benefits in air quality, public health, and disaster preparedness

- Strengthen project and program selection criteria to include the benefits for public health, air quality, and community-level hazard planning. For example, no program administering funds from the GGRF uses any criteria other than a reduction in GHG emissions and energy cost savings. This is limiting to the true value of any project.

- Allocate and award funding to projects and programs based on a system that accounts for the benefits to public health, air quality, disaster preparedness, and several other co-benefits in addition to emissions reduction.

Develop best practices in public health accounting methodologies

- California should fast-track development of quantification methodologies for public health co-benefits, including the use of full life-cycle accounting, so they can be factored into project evaluation processes as soon as possible. For instance, the Public Health Analysis Supplement of the Climate Change Draft Scoping Plan estimates that AB 32 implementation will prevent 320 premature deaths by 2020, in addition to 9,000 fewer instances of asthma and lower respiratory symptoms, and reduce 53,000 work loss days (California Air Resources Board, n.d.). Developing the use of similar criteria at the program and project level will ensure that projects are helping to reach these estimates in addition to reducing Greenhouse Gas emissions.

- The Air Resources Board should take a leadership responsibility for providing guidance on this issue to ensure consistency among programs and agencies.

Provide technical assistance and encourage cross-sector coordination and collaboration

- Increase funding to collaborative programs such as CalBRACE that address climate adaptation from the perspective of multiple sectors in an effort to maximize funding, GHG emissions reduction, and associated co-benefits.

- Provide technical assistance and advertise additional resources for rural communities to address hazard and emergency planning. This includes providing updated and easy-to-access information on available programs and grants, as well as modest assistance in accessing these resources.

Priority 5: Structural Recommendations

California's existing climate change policy, which includes large-scale funding for local projects, should be an important avenue for funding the implementation of *Safeguarding California* moving forward. Under AB32, cap-and-trade auction proceeds are distributed from the Greenhouse Gas Reduction Fund (GGRF) to further the overall goal of reducing emissions and improving conditions across the entire state. Between March 2014 and December 2015, over $2.6 billion was appropriated to state agencies to implement GHG reduction projects (CCI Annual Report 2016). The GGRF pays particular attention to investing in projects in the state's most disadvantaged communities, where vulnerability to climate change is disproportionately high.

Under SB 535, a minimum of 25% of auction proceeds and at least 10% of projects are invested in benefiting disadvantaged communities. CalEnviroScreen 2.0, CalEPA's tool for identifying disadvantaged communities, focuses primarily on urban areas through an emphasis on pollutants and other criteria that are not measured or do not occur in rural communities. This tool can preclude disadvantaged people in the Sierra Nevada from consideration for GGRF funds. Only 3 of the Sierra Nevada's 22 counties contain eligible census tracts, for a total of 54 eligible tracts. Los Angeles County, in contrast, contains 854 eligible tracts (Office of Environmental Health Hazard Assessment, 2015).

Modification in the way that pollution burden is measured, population characteristics are assessed, and implementation is carried out should be made to better facilitate investment in resilience-building activities in the Sierra Nevada (specific suggestions made below). Increased GGRF investment in the Sierra Nevada will better achieve AB 32's goal of statewide improvements and benefits to disadvantaged communities. For example, wildfire is the largest source of California's emissions of black carbon, a component of particulate matter that is a leading environmental risk factor for premature death. Investments towards reducing black carbon from Sierra Nevada wildfires can improve human health while significantly adding to the state's overall efforts to reduce emissions. Furthermore, investments in resilient infrastructure and natural lands have co-benefits that extend beyond the borders of the Sierra Nevada due to the ecosystem services that the region provides to the state.

California's 2030 climate change vision for natural and working lands includes a commitment to using the "best available science" to lead the way in informed policymaking. This commitment highlights the need for a process that incorporates scientific and analytical expertise across state agencies and includes external research. Agencies should leverage biophysical and socioeconomic expertise on the Sierra Nevada to more effectively direct GGRF funding to meet its climate goals.

The policy recommendations in this section focus primarily on updating the methodology used to identify disadvantaged communities for the purposes of directing California Climate Investments from the GGRF. Furthermore, they provide input on updating and streamlining implementation methodologies to allow for prioritization of activities with co-benefits and better delivery of funds in rural jurisdictions. This issue is currently being considered by the EO B-30-15 Technical Advisory Group (TAG) and its sub-TAG on equity and vulnerability. Aspects of the policy recommendations below may overlap with the TAG recommendations.

Policy Recommendations

Reform the DAC screening criteria to account for all disadvantaged people

- Replace CalEnviroScreen 2.0 with another tool or overlay additional criteria for identifying disadvantaged people in rural areas of the state. Many Sierra Nevada communities are disadvantaged based on below-average household incomes and health impacts from water contamination and air pollution from wildfire and other "non-urban" sources.
- Incorporate the criteria defining disadvantaged communities as used by the Department of Water Resources, which defines disadvantaged communities as those with a median income less than 80% of the statewide average.
- Amend pollution burden criteria to account for the lack of air quality monitoring in the Sierra Nevada region and consider allowing submission of localized data to accurately identify impacts.
- Fund the placement of sensors to provide useful indicator data for future decision-making.
- Include wildfire emissions in attainment and other calculations for purposes of determining impact and funding eligibility. These emissions are not contained in NAAQS non-attainment status and are also significant sources of GHG emissions, affecting air quality in rural mountain and foothill communities during the summer.
- Ensure that public health data, such as low birth-weight rates and asthma ER visits, are tracked by criteria that make sense for all regions of the state, such as tracking the residential address individuals seeking treatment, rather than the facility that provided the service. These indicators can be under-counted in rural areas where advanced neonatal or specialty disease care is not available because residents travel to urban areas to receive these services. Furthermore, many rural health incidents will go unreported altogether, as in the case of a visit to a rural health clinic or primary care physician rather than an ER.

Reform state funding implementation processes to account for all disadvantaged people

- Identify supplementary delivery mechanisms for GGRF funding in addition to Metropolitan Planning Organizations (MPOs).
- Assign a portion of the disadvantaged communities percentage allocations to rural areas.
- Develop a companion rural mechanism that parallels the Sustainable Communities Strategy process to achieve vehicle miles traveled (VMT) reduction goals and co-benefits in rural communities.
- Direct administering agencies to create dedicated pools within key GGRF funding programs specifically to support projects from rural communities that may not have access to the data modeling or other expertise needed to develop successful applications.
- Fast-track development of quantification methodologies for co-benefits, including the use of full life-cycle accounting per the Governor's Executive Order B-30-15, allowing for co-benefits to (a) be factored into project evaluation processes as soon as possible, and (b) be recognized, tracked and felt across California communities.

- In the Funding Guidelines, direct administering agencies to consider co-benefits in relation to GHG emission reduction benefits.
- Facilitate joint applications for GGRF funding between urban and rural areas.

References

Brink, S. (2015). Sierra Nevada listening session for climate adaptation in California: State of the forest industry. Nov. 25 2015. California Forestry Association.

CAL FIRE (California Department of Forestry and Fire Prevention) (2010). California's forests and rangelands: 2010 assessment. Retrieved June 29, 2016 from http://frap.fire.ca.gov/data/assessment2010/pdfs/california_forest_assessment_nov22.pdf

CAL FIRE (California Department of Forestry and Fire Prevention) (2016a). California forest and rangelands assessment (FRAP) tree mortality viewer. Retrieved May 2, 2016 from http://egis.fire.ca.gov/TreeMortalityViewer

CAL FIRE (California Department of Forestry and Fire Prevention) (2016b). DRAFT urban and community forestry program greenhouse gas reduction fund grant guidelines 2015/2016. Retrieved April 4, 2016 from http://calfire.ca.gov/Grants/downloads/UrbanForestry/CAL%20FIRE_UCF_GRANT%20GUIDELINES_DRAFT%201-13-16.pdf

California Air Resources Board (n.d.). Climate change draft scoping plan public health analysis supplement (Report). Retrieved April 26, 2016 from http://www.arb.ca.gov/cc/scopingplan/document/executive_summary_publichealth.pdf

California Air Resources Board (2015). Short-lived climate pollutant reduction strategy concept paper. Retrieved April 6, 2016 from http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf

California Air Resources Board (2015a). Appendix A: California SLCP emissions. Retrieved May 1, 2016 from http://www.arb.ca.gov/cc/shortlived/2015appendixa.pdf.

California Air Resources Board (2016). California climate investments 2016 annual report. Retrieved June 29, 2016 from http://arb.ca.gov/cc/capandtrade/auctionproceeds/cci_annual_report_2016_final.pdf

California Climate Change Center. (2006) Climate change impacts on high-elevation hydropower generation in California's Sierra Nevada: A case study in the upper american river. White Paper. Retrieved June 29, 2016 from http://www.energy.ca.gov/2005publications/CEC-500-2005-199/CEC-500-2005-199- SF.pdf

California Energy Commission (2015). Local climate snapshots. Retrieved April 4, 2016 from http://cal-adapt.org/tools/factsheet/

California Natural Resources Agency (2016). Safeguarding California: implementation action plans. Retrieved June 29, 2016 from http://resources.ca.gov/docs/climate/safeguarding/Safeguarding%20California-Implementation%20Action%20Plans.pdf

California Public Utilities Commission (CPUC) (2016). Resolution E-4770 commission motion authorizing procurement from forest fuelstock bioenergy facilities supplied from high hazard zones for wildfires and falling trees pursuant to the governor's emergency proclamation. Retrieved April 6, 2016 from http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M159/K391/159391196.pdf.

Caiola, S. (2015). Ironman deems Tahoe conditions too risky for its triathlons. Sacramento Bee, 23 Sept 2015. Retrieved June 29, 2016 from http://www.sacbee.com/sports/outdoors/article36329763.html

Cayan, D., Luers, A., Hanemann, M., Franco, G., Croes, B. (2006). Scenarios of climate change in California: an overview. Sacramento, CA: California Climate Change Center, Public Interest Energy Sierra Nevada Climate Adaptation & Mitigation Strategy 66 Resource Program. Retrieved April 4, 2016 from http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF

Headwaters Economics (2016). Economics profile system - Human dimensions toolkit. Retrieved May 1, 2016 from http://headwaterseconomics.org/tools/economic-profile-system/about

Laden, F., Schwartz, J., Speizer, F. E., & Dockery, D. W. (2006, March 15). Reduction in fine particulate air pollution and mortality - Extended follow-up of the Harvard six cities study. *American Journal of Respiratory Critical Care Medicine, 173*(6), 667–672. Retrieved April 7, 2016 from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2662950/.

Merriam, K., Safford, H., & Sawyer, S. (2013, October). A summary of current trends and probable future trends in climate and climate-driven processes in the Sierra Cascade Province, including the Lassen, Modoc, and Plumas national forests. Retrieved April 26, 2016, from http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3820062.pdf

Milken Institute (2013). Unleashing the power of the bio-economy. Lab Report. Retrieved June 13, 2016 from http://assets1b.milkeninstitute.org/assets/Publication/InnovationLab/PDF/BioEconFIL.pdf

Next 10 (2015). Regional economic and demographic snapshot: Sierra Nevada. Retrieved June 29, 2016 from http://next10.org/sites/next10.org/files/sierra%20nevada%20econ%20snapshot.pdf.

Office of Environmental Health Hazard Assessment (2015). CalEnviroScreen 2.0 results. Retrieved April 25, 2016 from http://oehha.maps.arcgis.com/apps/Viewer/index.html?appid=112d91534883426 3ab8ecd5c6da67f68.

Podolak, K., D. Edelson, S. Kruse, B. Aylward, M. Zimring, and N. Wobbrock. (2015). Estimating the water supply benefits from forest restoration in the northern Sierra Nevada. An unpublished report of The Nature Conservancy prepared with Ecosystem Economics. San Francisco, CA. Retrieved April 4, 2016 from http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/california/forest-restoration-northern-sierras.pdf

Risky Business (2014). The economic risks of climate change in the United States: California. Retrieved April 6, 2016 from http://riskybusiness.org/site/assets/uploads/2015/09/RiskyBusiness_Report_WEB_09_08_14.pdf

Rural Health Information Hub (n.d.). Rural emergency preparedness and response. Retrieved April 4, 2016 fromhttps://www.ruralhealthinfo.org/topics/emergency-preparedness-and-response

Sierra Nevada Conservancy (a). Sierra Nevada watershed improvement program. Retrieved April 22, 2016 from http://www.sierranevadaconservancy.ca.gov/our-work/sierra-nevada-wip

Sierra Nevada Conservancy (b). California headwaters partnership. Retrieved April 22, 2016 from http://www.sierranevadaconservancy.ca.gov/our-work/sierra-nevada-wip/cahdwtrsprtnrshp

Sierra Nevada Conservancy (c). System indicators. Retrieved April 22, 2016 from http://www.sierranevada.ca.gov/our-region/system-indicators

Sierra Nevada Conservancy (2010). System indicators: Demographics and economy. Retrieved April 22, 2016 from http://www.sierranevada.ca.gov/our-region/sys_ind_docs/1_1_population.pdf

Sierra Nevada Conservancy (2011). California's primary watershed. Retrieved April 26, 2016 from http://www.sierranevada.ca.gov/our-region/ca-primary-watershed.

Sierra Nevada Conservancy (2012). System indicators for water and air quality, temperature, precipitation, and snowpack. Retrieved April 4, 2016 from http://www.sierranevada.ca.gov/our-region/sys_ind_docs/airwaterclimatefinal.pdf/view

Sustainable Conservation (n.d.). Boosting groundwater for Central Valley farmers, communities. Retrieved April 22, 2016 from http://suscon.org/watersheds/kingsriver.php

The Nature Conservancy (2014). Reducing climate risks with natural infrastructure. Summary Report. Retrieved April 6, 2016 from http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/california/ca-green-vs-gray-report-2.pdf

U.S. Department of Agriculture, Forest Service (2014). Managing fire in California mixed-conifer forests. Retrieved June 29, 2016 from http://www.calforests.org/wp-content/uploads/2014/02/140131_Collins_Managing_Fire.pdf

Valley Vision (n.d.). Business resiliency in the Capital Region. Retrieved April 22, 2016 from http://valleyvision.org/projects/business-resiliency-in-the-capital-region

White House (2012). National bioeconomy blueprint. Retrieved June 29, 2015 from https://www.whitehouse.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf

Appendix 1: Policy Matrix

Theme	Policy Recommendation	Relevant *Safeguarding California* Sectors	High-Level State Themes	Relevant Existing State Legislation or Program	Interregional Opportunities and Connections
1. Integrated Watershed Investment	Invest in natural infrastructure across the state's distributed water network from the Sierra Nevada to the sea, starting with forest and meadow restoration at the top of the watershed	Forestry; Water; Biodiversity and Habitat	Infrastructure, Natural Lands	California Water Action Plan, Sierra Nevada Conservancy's Watershed Improvement Plan (WIP), Governor's Executive Order B-30-15	Payment for ecosystem services mechanisms linking upstream and downstream communities; natural infrastructure high in watershed linked with water efficiency and flood control lower; partnerships with water and energy utilities, state, and USFS
1. Integrated Watershed Investment	Create and maintain existing inter-regional and multi-party funding mechanisms to magnify impact and secure watershed services	Forestry; Water; Agriculture; Biodiversity and Habitat	Natural Lands, People	Sierra Nevada Conservancy's WIP, IRWM	Alliance of Regional Collaboratives for Climate Adaptation (ARCCA) and other inter-regional planning opportunities to identify mutually beneficial projects that span multiple IRWM regions
2. Forest Restoration	Direct GHG Reduction Funds to forest restoration projects and incentives to maintain working forests	Forestry; Water; Biodiversity and Habitat	Infrastructure, Natural Lands, People	Sierra Nevada Conservancy's WIP, Good Neighbor Authority between state and USFS; Strategic Growth Council's Sustainable Agricultural Land Conservation Program	Partnerships between air quality districts; protection of ecosystem services upstream of downstream users including water, carbon, and recreation

Theme	Policy Recommendation	Relevant *Safeguarding California* Sectors	High-Level State Themes	Relevant Existing State Legislation or Program	Interregional Opportunities and Connections
2. Forest Restoration	Foster continued growth of biomass power sector in the Sierra Nevada	Energy, Forestry	Infrastructure, Natural Lands, People	AB 590; CPUC Resolution E-4770	Renewable energy distributed to local and statewide consumers
2. Forest Restoration	Support quantification of climate benefits and co-benefits of forest restoration	Forestry; Water; Biodiversity and Habitat; Public Health; Emergency Management	Natural Lands, People	Forest Carbon Action Plan; Short-Term Climate Pollutants Plan; CAL FIRE's Urban Forestry Grant Guidelines	Improved public health and emergency management coordination and outcomes for people throughout California affected by air quality effects of wildfire; secure wildlife and recreation benefits are adequately protected on behalf of all Californians
3. Regional Economic Development	Expand the Affordable Housing Sustainable Communities' (AHSC) Rural Innovation Project Area (RIPA) program, extend AHSC to tribal lands	Public Health; Transportation; Biodiversity and Habitat	Infrastructure, Natural Lands, People	Affordable Housing Sustainable Communities (AHSC), AB32 Greenhouse Gas Reduction Fund	Recognition of the need for protection and management of the state's primary watershed for to protect water supply for downstream users
3. Regional Economic Development	Explore the use of alternative financing instruments to leverage downstream capital to fund resilience projects and create rural jobs	Public Health; Transportation; Biodiversity and Habitat	Infrastructure, Natural Lands, People	Affordable Housing Sustainable Communities (AHSC), AB32 Greenhouse Gas Reduction Fund	Partnerships between urban and rural areas to finance natural resource restoration and protection activities based on shared dependence
4. Preparedness and Public Health	Prioritize policies that create co-benefits	Public Health, Emergency Management	People	AB 32 (§38562) requirement to consider co-benefits	Regions consider public health co-benefits of GHG-reducing projects in areas outside their immediate region

Theme	Policy Recommendation	Relevant *Safeguarding California* Sectors	High-Level State Themes	Relevant Existing State Legislation or Program	Interregional Opportunities and Connections
4. Preparedness and Public Health	Develop best practices in public health accounting methodologies	Public Health, Emergency Management	People		Statewide consensus on method for accounting for public health co-benefits
4. Preparedness and Public Health	Encourage cross-sector coordination and collaboration	Public Health, Emergency Management	People	California Department of Public Health CalBRACE program	Partnerships between emergency preparedness and county public health departments to coordinate efforts for disasters
5. Structural Recommendations	Improve GGRF disadvantaged communities screening criteria to allow greater investment in the Sierra Nevada	Forestry; Public Health; Emergency Management	People	AB 32 Greenhouse Gas Reduction Fund	Improved use of GGRF funding towards achieving AB32's statewide goals
5. Structural Recommendations	Identify supplementary delivery mechanisms for GGRF funding in addition to Metropolitan Planning Organizations (MPOs)	Forestry; Public Health; Emergency Management	People	AB 32 Greenhouse Gas Reduction Fund	Improved use of GGRF funding towards achieving AB32's statewide goals

Appendix 2: Sierra CAMP California Region Boundary